Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

FOD FILE COPY

CLASSIFICATION CONFIDENTIAL **CONFIDENTIAL**

CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT

CD NO.

50X1-HUM

COUNTRY USSR

DATE OF INFORMATION 1948

SUBJECT Scientific - Geophysics, geodesy

HOW PUBLISHED Book

DATE DIST. 27 Jan 1951

WHERE PUBLISHED Mos ow

NO. OF PAGES 7

DATE PUBLISHED 1948

SUPPLEMENT TO REPORT NO.

LANGUAGE Russian

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF ESPIONAGE ACT 50 U. S. C., 31 AND 32, AS AMENDED. ITS TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW. REPRODUCTION OF THIS FORM IS PROHIBITED.

THIS IS UNEVALUATED INFORMATION

SOURCE Osnovy Postroveniya Opornykh Geodezicheskikh Setey, Geodezizdat,

50X1-HUM

NOTES ON AND TABLE OF CONTENTS FOR
"PRINCIPLES OF CONSTRUCTING BASE GEODETIC NETWORKS"
BY B. N. RABINOVICH

This book, approved by the Ministry of Higher Education USSR as a textbook for cartographic faculties of geodetic institutes, was written by the author to serve as a text for a course which he was teaching at the Moscow Institute for Geodetic, Aerial Surveying, and Cartographic Engineers. This course, "Principles Governing the Construction of State Base Geodetic Networks," requires some 150 hours of lectures and field work, and is aimed at familiarizing the cartographer with those problems of higher geodesy and astronomy which he encounters in his practical work. Prof F. N. Krasovskiy and Docent A. A. Izotov aided in compiling and editing this book. These two men drew up the ellipsoid which by decree of the Council of Ministers USSR of 7 April 1946 was adopted as the Ellipsoid of Reference for geodesic and cartographic works in the USSR. This ellipsoid, with length of the major or equatorial semiaxis $a = 6,378,245$ meters and flattening $\alpha = 1:298.3$, was chosen to replace the Bessel ellipsoid ($a = 6,377,397$ meters and $\alpha = 1:299.2$), which geodetic practice showed did not reflect accurately enough the size and shape of the earth within the boundaries of the USSR.

Table of Contents

	Page
Foreword	3
I. Introduction	
1. Geodetic Concepts of the Earth's Shape	5
2. Importance of Planning and Height Points for Topographic Surveys and Compilation of Maps	7
3. Methods for Determining Planning Base Points	9

CONFIDENTIAL

CLASSIFICATION CONFIDENTIAL

STATE	X	NAVY	X	NSRB		DISTRIBUTION																	
ARMY	X	AIR	X	FBI																			

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

50X1-HUM

		Page
4.	Importance of Astronomical Points in Cartography	12
5.	Methods for Determining Height Base Points	14
6.	Basic Concepts Governing the Use of Base Networks for Topographic Surveys and the Compilation of Maps	18

PART 1. GEODETIC METHODS FOR DETERMINING BASE POINTS

II. Basic Principles Governing the Construction of State Triangulation in the USSR

7.	Density of Points of the Base Geodetic Network. General Considerations on the Construction of Triangulation	22
8.	System and Program for Class I Triangulation in the USSR	23
9.	System for Class II Triangulation in the USSR and Its Fulfillment	25

III. Accuracy of Triangulation Elements

10.	Concept of Error in Length of a Side of a Simple Chain of Triangles. Error of Geometric Connection	28
11.	Error of the Geodetic Azimuth of the Connecting Side in a Chain of Triangles	33
12.	Considerations on the Frequency of Bases and the Length of a Class I Triangulation Link	33
13.	Longitudinal and Transverse Shifts of Triangulation Links. Calculation of Errors in Coordinates of Points of the Trigonometric Network	35

IV. Stages in Triangulation

14.	General Information on Organization of Work	39
15.	Requirements for Selection of Triangulation Points	40
16.	Concept of Surveying Means and Methods	41
17.	Selection of a Base and Layout of Base Network	45
18.	Materials Obtained as a Result of Reconnaissance	47
19.	Designation and Strengthening of Triangulation Points at a Site	47

V. Base Measurements

20.	Concept of Normal Measures; Past and Present Normal Measures	52
21.	Yederin Base Instrument	55
22.	Sources of Measurement Errors Inherent in the Yederin Instrument	57

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

50X1-HUM

		Page
23.	Order of Base Measurement with the Yederin Instrument; Evaluating the Accuracy of Results Obtained	59
24.	Types of Base Networks	61
VI.	Instruments Used to Measure Angles in Triangulation	
25.	Geodetic Theodolite Used in the USSR for Class I Triangulation	62
26.	Specifications for Design of Instruments Used in Class II and Lower Triangulation	64
27.	Types of Instruments Used in Class II and Lower Triangulations	67
28.	Instruments for Taking Readings from Circles	72
29.	Vertical Circle Unit	76
30.	Action of Instrumental Errors	77
31.	Calibration and Adjustment of the Instrument	80
VII.	Measurement of Horizontal Angles and Zenith Distances in Class II and Lower Triangulations	
32.	Most Advantageous Time for Measuring Horizontal and Vertical Angles	82
33.	Methods for Measuring Horizontal Angles	82
34.	Elements of Reductions and Methods for Determining Them	86
35.	Formulas For Computing Corrections for Centering and Reduction	89
36.	Processing of Directions Measured at a Point. Evaluation of Results	91
37.	Methods for Measuring Zenith Distances	95
38.	Materials Used in Angular Measurements	96
VIII.	Basic Concepts Governing Equational Calculations in Triangulation	
39.	Purpose of Equational Calculations in Fill-in Networks	96
40.	Forms of Conditional Equations	98
41.	Permissible Dimensions of Free Terms of Conditional Equations	104
42.	Steps in Equating a Free Network to a Plane by the Method of Conditional Equations	108
43.	An example of Equational Calculations in a Free Fill-in Network of Class II (on a plane)	110

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

Page

44. Examples of Drawing up Conditional Equations Arising in a Nonfree Network 118

45. Forms of Error Equations for Equating Triangulation by Method of Direct Observations 122

46. Some Information on Calculation Materials in Triangulation 124

IX. Geodetic Leveling

47. Formula for One-Sided Geodetic Leveling 125

48. Formula for Two-Sided Geodetic Leveling 128

49. Accuracy of Geodetic Leveling 129

50. Possibility of Use of Geodetic Leveling in Geographical Studies 131

X. Polygonometric Method for Determining Base Points

51. System and Classification of Polygonometry 133

52. Traverses of Classes II and III; Selection of the Path; Signs and Centers 135

53. Instruments and Methods of Measurements; Checking the Work 136

54. Concept of Parallactic Polygonometry 137

55. Transfer of Heights in Polygonometry; Leveler-Theodolite Works 139

56. Use of Precise Polygonometry for Cartographic Purposes 143

57. Materials Used in Precise Polygonometry 145

PART 2. ASTRONOMICAL METHODS FOR DETERMINING BASE POINTS

XI. Coordinates and Daily Movements of Stars and Measurement of Time

58. Subject of Astronomy as Applied to Construction of Geodetic Networks 146

59. Celestial Sphere; Points and Circles on It 147

60. Systems of Celestial Coordinates 149

61. Daily Movement of Stars 150

62. Sidereal Days and Sidereal Time 151

63. Time Measurements According to the Sun; Time, Mean, and Civil Time 152

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

		Page
64.	Local and Greenwich Time; Zone and Statutory Time	153
65.	Ratio Between Sidereal Time and Mean Time	155
66.	Tables of the Solar Astronomical Yearbook	157
67.	Converting Times (e.g., from Greenwich to local); Examples	159
XII.	Basic Concepts of Astronomical Determinations	
68.	Classification of Astronomical Points	162
69.	Some Formulas of Spherical Trigonometry	163
70.	The Parallax	167
71.	General Considerations on Determination of Latitude, Longitude, and Azimuth	168
72.	Chronometers. Basic Data on Their Construction and Use in Astronomical Determinations	171
73.	Determination of Chronometer Errors According to Zenith Distances of Stars	174
74.	Method for Determining Latitude of a Site From Zenith Distances of Stars	176
75.	Determination of Azimuth of a Terrestrial Object by the Pole Star	178
76.	Determination of Azimuth by the Sun	181
77.	Determination of Azimuth by Prof Krasovskiy's Method	186
78.	Methods of Determining Difference in Longitude	188
79.	Purpose of a Radio Time Service in Connection with Determination of Longitude Difference	192
	PART 3. ELEMENTS OF SPHERICAL GEODESY	
XIII.	Basic Formulas and Relationships on the Terrestrial Spheroid	
81.	Ellipsoid of Reference and General Considerations on Establishing Its Size	194
82.	Geodetic Coordinates and Their Connection With an Auxiliary Rectangular Coordinate System	196
83.	Main and Average Radii of Curvature	198
84.	Formulas for Determining the Lengths of Arcs of Meridians and Parallels	202

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

50X1-HUM

Page

XIV. Calculation of Lineal and Superficial Elements Belonging to Surface of Ellipsoid

85. Use of Tables and Formulas for Calculating Lengths of Arcs of Meridians and Parallels 206

86. Determination of Areas of Trapezoids 209

87. Determination of Frames of Surveying Trapezoids in a Polyhedral Projection 212

88. Solution of Small Spheroidal Triangles by Legendre Theorem 216

XV. Calculation of Geographical Coordinates

89. General Concepts on Solution of Main Geodetic Problem 220

90. Schreiber's Formula for Solving Direct Geodetic Problem 221

91. Solution of Direct Geodetic Problem by Means of Gauss's Simplified Formulas 229

92. Inverse Geodetic Problem by Means of Gauss's Simplified Formulas. Examples 233

XVI. Gauss-Kruger Plane Rectangular Coordinates

93. Meaning and Method of Using Gauss-Kruger Projection 239

94. Formulas for Converting from Geodetic Coordinates to Gauss-Kruger Coordinates 243

95. Converting from Gauss-Kruger to Geodetic Coordinates 250

96. Formulas for Gaussian Approximation of Meridians 254

97. Determination of Scale in Gauss-Kruger Projection 256

98. Reduction of Distances and Directions to a Plane 258

99. Calculations Made in Reduction of Triangulation to a Plane in Gauss-Kruger Projection 262

100. Concerning Transformation of Gauss-Kruger Coordinates of a Given Zone Into Neighboring Zone /includes Izotov's Tables/ 269

101. Superposition of a Rectangular Network on a Geographical Network and Vice Versa 273

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9

50X1-HUM

SUPPLEMENT

		Page
XVII.	Survey and Use of Results of Geodetic and Astronomical Works in USSR	
102.	Some Information on Development of Astronomical and Geodetic Works in USSR	280
103.	General Information on Triangulation Works of Nineteenth Century	282
104.	Main Features of Triangulations of Russia Carried Out in Nineteenth Century	285
105.	Simplified Differential Formulas for Recalculating Coordinates from System of One Ellipsoid into System of Another	290
106.	Triangulations of the Corps of Military Topographers During the Period 1906 - 1918; Contemporary Triangulations of USSR	293
107.	Leveling Works on the Territory of USSR; Their Development and Status	297
108.	Past and Present Astronomical Determinations in USSR	300
109.	Use of Astronomical Points in Field Cartography	303
110.	Past and Present Catalogs of Triangulation, Astronomical, and Leveling Works in USSR	306
Bibliography		314
Alphabetical Index		316

- E N D -

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370605-9